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*Arabidopsis thaliana* FAE1 (SEQ ID NO:2)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFEASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMSVNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTR  
THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYPVD FKLAVDHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKNKAW  
QIALGSGFKC NSAVWVALRN VKASANSPWQ HCIDRYPVKI DSDLSKSKTH  
VQNGRS

*Brassica napus* elongase KCS (SEQ ID NO:4)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLQ  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDD SLDLFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFEASREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKNKVV  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

*B. napus* elongase KCS (SEQ ID NO:6)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYLTIDDL HHHLYYSYLQ  
NLITIAPLLA FTVFGSVLYI ATRPKPVYLV EYSCYLPPTH CRSSISKVMD  
IFFQVRKADP SRNGTCDDSS WLDFLRKIQE RSGLGDETHG PEGLLQVPPR  
KTFARAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
MNVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVVSTE  
NITYNIYAGD NRSMMVSNC LFRVGGAAIL SNKPRDRRRS KYELVHTRV  
HTGADDKSFR CVQQGDDENG QTGVSLSKDI TDVAGRTVKK NIATLGPLIL  
PLSEKLLFFV TFMGKKLFFD EIKHYYPDF KLAIIDHFCIH AGGKAVIDVL  
EKNLGLAPID VEASRSTLHR FGNTSSSSIW YELAYIEPKG RMKGKNKVWQ  
IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
PNGRS

FIGURE 1-1

At114 (SEQ ID NO:8)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLOH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNGTCDD S WLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLKF DKIKHYYPV FKLAI DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VPNGRS

At74 (SEQ ID NO:10)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLOH  
NLITVTLLFA FTVFGLVLYI VTRPKPVYLV EYSCYLPPH CRSSISKVMD  
IFYQVRKADP SRNGTCDDSS WLDFLRKIQE RSGLGDETHG PEGLLQVPPR  
KTFAAAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
MVVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVSTE  
NITYNIYAGD NRSMMVSNCL FRVGGAAILL SNKPGDRRRS KYELVHTVRT  
HTGADGKSFR CVQQGDDENG KIGVSLSKDI TDVAGRTVKK NIATLGPLIL  
PLSEKLLFFV TFMGKKLFD KIKHYYPDF KLAI DHFCIH AGGRAVIDVL  
EKNLALAPID VEASRSTLHR FGNTSSSSIW YELAYIEAKG RMKGKNKVWQ  
IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
QNGRS

At114 L91C K92R (SEQ ID NO:12)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLOH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **CRVSVSKVMD**  
IFYQIRKADT SSRNGTCDNS WLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLKF DKIKHYYPV FKLAI DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VPNGRS

FIGURE 1-2

At114 K92R (SEQ ID NO:14)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LRVSVSKVMD  
IFYQIRKADT SSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAIHDFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VPNGRS

At114 G307D (SEQ ID NO:16)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADDKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPV FKLAIHDFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKGKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

At74 G306D (SEQ ID NO:18)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPKPVYLV EYSCYLPPTH CRSSISKVMD  
IFYQVRKADP SRNGTCDDSS WLDFLRKIQE RSGLGDETHG PEGLLQVPPR  
KTFAAAREET EQVIIGALEN LFKNTNVNPK DIGILVVNSS MFNPTPSLSA  
MVVNTFKLRS NVRSFNLGGM GCSAGVIAID LAKDLLHVHK NTYALVVSTE  
NITYNIYAGD NRSMMVSNC LFRVGGAAIL LSNKPGDRRRS KYELVHTVRT  
HTGADDKSFR CVQQGDDENG KIGVSLSKDI TDVAGRTVKK NIATLGPLIL  
PLSEKLLFFV TFMGKKLFFD KIKHYYPDF KLAIDHFCIH AGGRAVIDVL  
EKNLALAPID VEASRSTLHR FGNTSSSSIW YELAYIEAKG RMKGKGNKVWQ  
IALGSGFKCN SAVWVALNNV KASTNSPWEH CIDRYPVKID SDSGKSETRV  
QNGRS

FIGURE 1-3

At114 L91C K92R G307D (SEQ ID NO:20)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **CRVSVSKVMD**  
IFYQIRKADT SSRNGTCDNS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADDKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFK DKIKHYYPVDP FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

At114 K92R G307D (SEQ ID NO:22)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **LRVSVSKVMD**  
IFYQIRKADT SSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADDKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFK DKIKHYYPVDP FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

At254 (SEQ ID NO:24)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNLLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH **LKVSVSKVMD**  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMSVNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFK DKIKHYYPVDP FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGNKVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VPNGRS

FIGURE 1-4

At173 (SEQ ID NO:26)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFK DKIKHYYVPD FKLAI DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKQVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

Bn176 (SEQ ID NO:28)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLO  
HNLITIAPLF AFTVFGSVLY IATRPKPYLV VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKL VHTVR  
THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYVPD FKLAV DHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKQAW  
QIALGSGFKC NSAVWVALRN VKASANSWPQ HCIDRYPVKI DSDLSKSKTH  
VQNGRS

At399 (SEQ ID NO:30)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAkdLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKL VHTVR  
THTGADDKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYVPD FKLAV DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMKKGKQVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

FIGURE 1-5

Bn399 (SEQ ID NO:32)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLO  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYVPD FKLAI DHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKAW  
QIALGSGFKC NSAVWVALRN VKASANSPWQ HCDRYPVKI DSDLKSKTH  
VQNGRS

Bn G307D (SEQ ID NO:34)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLO  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGADGKSF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYVPD FKLAI DHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKVV  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCDRYPVKI DSDSGKSETR  
VQNGRS

At K92R (SEQ ID NO:36)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLOH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPTH LRVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITQGIYAG ENRSMMVSNC LFRVGGAAIL LSNKSGDRRR SKYKLVHTVR  
THTGADGKSF RCVQQEDDES GKIGVCLSKD ITNVAGTTLT KNIATLGPLI  
LPLSEKFLFF ATFVAKKLLK DKIKHYYVPD FKLAVDHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKAW  
QIALGSGFKC NSAVWVALRN VKASANSPWQ HCDRYPVKI DSDLKSKTH  
VQNGRS

FIGURE 1-6

At254 G307D (SEQ ID NO:38)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFENTKVNP REIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNIKSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGAD~~DK~~SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKQVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

At173 G307D (SEQ ID NO:40)

MTSVNVKLLY RYVLTNFFNL CLFPLTAFLA GKASRLTIND LHNFLSYLQH  
NLITVTLLFA FTVFGLVLYI VTRPNPVYLV DYSCYLPPPH LKVSVSKVMD  
IFYQIRKADT SSRNVACDDP SSLDFLRKIQ ERSGLGDETY SPEGLIHVPP  
RKTFAASREE TEKVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGAD~~DK~~SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPVD FKLAIDHFCI HAGGRAVIDV  
LEKNLALAPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKQVW  
QIALGSGFKC NSAVWVALNN VKASTNSPWE HCIDRYPVKI DSDSGKSETR  
VQNGRS

Bn399 G307D (SEQ ID NO:42)

MTSINVKLLY HYVITNLFNL CFFPLTAIVA GKAYRLTIDD LHHLYYSYLO  
HNLITIAPLF AFTVFGSVLY IATRPKPVYL VEYSCYLPPT HCRSSISKVM  
DIFYQVRKAD PSRNGTCDDS SWLDFLRKIQ ERSGLGDETH GPEGLLQVPP  
RKTFAAAREE TEQVIIGALE NLFKNTNVNP KDIGILVVNS SMFNPTPSLS  
AMVVNTFKLR SNVRSFNLGG MGCSAGVIAI DLAKDLLHVH KNTYALVVST  
ENITYNIYAG DNRSMMVSNC LFRVGGAAIL LSNKPGDRRR SKYELVHTVR  
THTGAD~~DK~~SF RCVQQGDDEN GKIGVSLSKD ITDVAGRTVK KNIATLGPLI  
LPLSEKLLFF VTFMGKKLFF DKIKHYYPVD FKLAIDHFCI HAGGRAVIDE  
LEKNLGLSPI DVEASRSTLH RFGNTSSSSI WYELAYIEAK GRMCKGNKAW  
QIALGSGFKC NSAVWVALRN VKASANS~~P~~WQ HCIDRYPVKI DSDLSKSKTH  
VQNGRS

FIGURE 1-7



*Arabidopsis thaliana* FAE1 (SEQ ID NO:1)

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tctcgcctcg atttcttgag gaagattcaa gagcgttcag  
gtctaggtga tgagacgtac agtcttgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggtcg ttaatacttt caagctccga agcaacatca aaagctttaa  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
agtcgggaga ccggagacgg tccaagtaca agctagttca cacgggtccga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttta gcgaaaagtt tctttttttc gctaccttcg tcgccaagaa  
acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
aacgttacat agatttggga atacttcac tagctcaatt tggatatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc  
tctacgcaat gtcaaggcat cggcaaatag tccttggcaa cattgcatcg  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggtccta atttgatgta tctgagtgcc aacgtttact  
ttgtctttcc tttcttttat tggttatgaa ttagatgttt actaatgttc  
ctctcttttt cgttataaat aaagaagttc aattcttcct atagtttcaa  
acgcgatttt aagcgtttct atttaggttt acatgaattt cttttacaaa  
ccatctttt

FIGURE 2-1

*Brassica napus* elongase KCS (SEQ ID NO:3)

```

atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgttaacggc gatcgctgcc ggaaaagcct
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcgggtc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caagggtcatg
gatatctttt atcaagtaag aaaagctgat ccttctcgga acggcacgtg
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccaggg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcatggtcgc ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atggggtgta gtgccggcgt tatagccatt gatctagcaa
aggacttgtt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt
ttcaaattgc ttggtccgtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacgggtcga
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacgggttaag aaaaacatag caacgttggg tccggtgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttggaa acacttcac tagctcaata tgggtatgagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta ataa

```

FIGURE 2-2

*B. napus* elongase KCS (SEQ ID NO:5)

```

tagagcgtaa cggaccacaa aagaggatcc atacaaatac atctcatcgc
ttccattact attctccgac acacacactg agcaatgacg tccattaacg
taaagctcct ttaccattac gtcataacca accttttcaa cctttgtttc
tttccattaa cggcgatcgt cgccggaaaa gcctatctta ccatagacga
tcttcaccac ttatactatt cctatctcca acacaacctc ataaccattg
ctccactctt ggccttcacc gttttcgggtt cggttctcta catcgcaacc
cggcccaaac cggtttacct cgtggagtag tcatgctacc ttccaccaac
gcattgtaga tcaagtatct ccaagggtcat ggatatcttt ttccaagtaa
gaaaagctga tccttctcgg aacggcacgt gcgatgactc gtcctggcctt
gacttcttga ggaagattca agaacgttca ggtctaggcg atgaaacca
cgggcccagag gggctgcttc aggtccctcc ccggaagact tttgcgcgcg
cgcgtgaaga gacggagcaa gttatcattg gtgcgctaga aaatctattc
aagaacacca atgttaacct taaagatata ggtatacttg tggatgaactc
aagcatgttt aatccaactc ctctcgctctc cgcgatggtc gttaacactt
tcaagctccg aagcaacgta agaagcttta accttggtgg catgggttgt
agtgccggcg ttatagccat tgatctagca aaggacttgt tgcattgtcca
taaaaatacg tatgctcttg tggtagcac agagaacatc acttataaca
tttacgctgg tgataatagg tccatgatgg tttcaaattg cttgttccgt
gttggtgggg ccgctatttt gctctccaac aagcctagag atcgtagacg
gtccaagtac gagctagttc acacgggttcg aacgcatacc ggagctgacg
acaagtcttt tcgttgcgtg caacaaggag acgatgagaa cggccaaacc
ggagtgaagt tgtccaagga cataaccgat gttgctggtc gaacgggtaa
gaaaaacata gcaacgctgg gtccggtgat tcttccgtta agcgagaaac
ttcttttttt cgttaccttc atgggcaaga aacttttcaa agacgaaatc
aaacattatt acgtcccgga cttcaagctt gctatcgacc atttttgtat
acatgccgga ggcaaagccg tgattgatgt gctagagaag aacctaggcc
tagcaccgat cgatgtagag gcatcaagat caacggtaca tagatttgga
aacacttcat ctagctcaat atggtatgag ttggcataca tagaacccaa
aggaaggatg aagaaaggta ataaagtttg gcagattgct ttagggtcag
gctttaagtg taacagtgca gtttgggttg ctctaaacaa tgtcaaagct
tcaacaaata gtccttgga acactgcac gacagatacc cgggttaaaat
tgattctgat tcaggtagt cagagactcg tgtcccaaac ggtcggctct
aataaatgat gtttgctctc tttcgtttct ttttattggt tataataatt
tgatggccac gatgtttctc ttgtttgtta tgaataaaga atcccacggt
gttctagtaa aaaaaaaaaa aaaaaaaaaa aaaaaa

```

FIGURE 2-3

At114 (SEQ ID NO:7)

atgacgtccg ttaacgttaa gctcctttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc gccaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtagaag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgcggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggg gataataggt ccatgatggt  
ttcaaattgc ttgttcggtg ttggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagtcca cacggttcga  
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
actttttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggtagagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtcccaaacg gtcggtccta a

FIGURE 2-4

At74 (SEQ ID NO:9)

```

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt
tctctacatc gtaaccgcac ccaaaccggt ttacctcggt gagtactcat
gctaccttcc accaacgcat tgtagatcaa gtatctccaa ggtcatggat
atcttttatc aagtaagaaa agctgatcct tctcggaacg gcacgtgcga
tgactcgtcg tggcttgact tcttgaggaa gattcaagaa cgttcaggtc
taggcgatga aactcacggg cccgaggggc tgcttcaggc ccctccccgg
aagacttttg cggcggcgcg tgaagagacg gagcaagtta tcattggtgc
gctagaaaat ctattcaaga acaccaacgt taaccctaaa gatataggta
tacttggtgt gaactcaagc atgtttaatc caactccatc gctctccgcg
atggtcggtt acactttcaa gctccgaagc aacgtaagaa gctttaacct
tggtggcatg ggttgtagtg ccggcggtat agccattgat ctagcaaagg
acttgttgca tgtccataaa aatacgtatg ctcttggtgt gagcacagag
aacatcactt ataacattta cgctggtgat aatagggtcca tgatggttcc
aaattgcttg ttccgtggtg gtggggccgc tattttgctc tccaacaagc
ctggagatcg tagacgggcc aagtacgagc tagttcacac gggtcgaacg
cataccggag ctgacggcaa gtcttttcgt tgcgtgcaac aaggagacga
tgagaacggc aaaatcggag tgagtttgtc caaggacata accgatgttg
ctggtcgaac ggttaagaaa aacatagcaa cgttgggtcc gttgattctt
ccgttaagcg agaaacttct ttttttcggt accttcattg gcaagaaact
tttcaaagat aaaatcaaac attactacgt cccggatttc aaacttgcta
ttgaccattt ttgtatacat gccggaggca gagccgtgat tgatgtgcta
gagaagaacc tagccctagc accgatcgat gtagaggcat caagatcaac
gttacataga tttggaacaa cttcatctag ctcaatatgg tatgagttgg
catacataga agcaaaaagga aggatgaaga aaggtaataa agtttggcag
attgcttttag ggtcaggctt taagtgtaac agtgcagttt ggggtggctct
aaacaatgtc aaagcttcga caaatagtcc ttgggaacac tgcacgcaca
gataccgggt caaaattgat tctgattcag gtaagtcaga gactcgtgtc
caaaacggtc ggtcctaa

```

FIGURE 2-5

At114 L91C K92R (SEQ ID NO:11)

atgacgtccg ttaacgttaa gctcctttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc gccaccgcat **tgacagagtta** gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgataattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
ttcaaattgc ttgttcctg ttggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtag agctagtcca cacggttcga  
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
actttttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtcccaaacg gtcggtccta a

FIGURE 2-6

At114 K92R (SEQ ID NO:13)

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actcctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc gccaccgcat ct**cag**agtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgtaaacctt aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggg  
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacgggttaag aaaaacatag caacgttggg tccggttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tgggtatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtcccaaacg gtcggtccta a

FIGURE 2-7

At114 G307D (SEQ ID NO:15)

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaaggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc gccacccgat ctcaaagtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
ttcaaattgc ttgttccgtg ttgggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
acgcataccg gagctgacga caagtctttt cgttgcgtgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg cttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-8



At74 G306D (SEQ ID NO:17)

```

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct
ctcggccttac cataaacgat ctccacaact tcctttccta tctccaacac
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt
tctctacatc gtaacccgac ccaaaccggt ttacctcggt gagtactcat
gctaccttcc accaacgcat tgtagatcaa gtatctccaa ggtcatggat
atcttttatac aagtaagaaa agctgaccc tctcggaacg gcacgtgcga
tgactcgtcg tggttgact tcttgaggaa gattcaagaa cggtcaggtc
taggcgatga aactcacggg cccgaggggc tgcttcagggt cctccccggg
aagacttttg cggcggcgcg tgaagagacg gagcaagtta tcattggtgc
gctagaaaat ctattcaaga acaccaacgt taaccctaaa gatataggta
tacttggtgt gaactcaagc atgtttaatc caactccatc gctctccgcg
atggtcgtta acactttcaa gctccgaagc aacgtaagaa gctttaacct
tggtggcatg ggttgtagtg ccggcggtat agccattgat ctagcaaagg
acttggttgca tgtccataaa aatacgtatg ctcttggtgt gagcacagag
aacatcactt ataacattta cgctgggtgat aatagggtcca tgatggtttc
aaattgcttg ttccgtgttg gtggggcgcg tattttgctc tccaacaagc
ctggagatcg tagacggtcc aagtacgagc tagttcacac ggttcgaacg
cataccggag ctgacgacaa gtcttttcgt tgcgtgcaac aaggagacga
tgagaacggc aaaatcggag tgagtttgct caaggacata accgatgttg
ctggtcgaac ggtaagaaa aacatagcaa cgttgggtcc gttgattctt
ccgttaagcg agaaacttct ttttttcggt accttcattg gcaagaaact
tttcaaagat aaaatcaaac attactacgt cccggatttc aaacttgcta
ttgaccattt ttgtatacat gccggaggca gagccgtgat tgatgtgcta
gagaagaacc tagccctagc accgatcgat gtagaggcat caagatcaac
gttacataga tttggaacaa cttcatctag ctcaatatgg tatgagttgg
catacataga agcaaaagga aggatgaaga aaggtaataa agtttggcag
attgcttttag ggtcaggctt taagtgtaac agtgcagttt ggggtggctct
aaacaatgtc aaagcttcga caaatagtcc ttgggaacac tgcacgcaca
gatacccggt caaaattgat tctgattcag gtaagtcaga gactcgtgtc
caaaacggtc ggtcctaa

```

FIGURE 2-9

At114 L91C K92R G307D (SEQ ID NO:19)

atgacgtccg ttaacgttaa gtccttttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcgggttggt  
tctctacatc gtaaccogac ccaatccggg ttatctcggt gactactcgt  
gttaccttcc gccaccgcat **tg**cagagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgataattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgtaaccct aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atggggttga gtgccggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggg gataataggc ccatgatggg  
ttcaaattgc ttgttccgtg ttgggtggggc cgctatthttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
acgcataccg gagctgacga **ca**agtcctttt cgthtgctgc aacaaggaga  
cgatgagaac ggcaaaatcg gactgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacgggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaaact tctthttttt gttaccttca tgggcaagaa  
actthttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca thtttgata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagthttg  
cagattgctt tagggtcagg cthtaagtgt aacagtgcag thttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgc  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcgggtccta a

FIGURE 2-10

At114 K92R G307D (SEQ ID NO:21)

atgacgtccg ttaacgttaa gctcctttac cgttatgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaaccgc gttcctcgcc ggaaaagcct  
ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc gccaccgcat ct**cag**agtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acggcacgtg  
tgatgattcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc  
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa cgtaaaccct aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcatggtcgc ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggg gataataggt ccatgatggt  
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtagc agctagttca cacggttcga  
acgcataccg gagctgac**ga** caagtctttt cgttgctgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggtatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg cttaaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-11

At254 (SEQ ID NO:23)

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggttac cataaacgat ctccacaacc tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttactgttt tcggtttggt  
tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcttgag gaagattcaa gagcgttcag  
gtctaggtga tgagacgtac agtcttgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctg ttaatacttt caagctccga agcaacatca aaagctttaa  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
aagacttggt gcatgttcat aaaaacactt atgctctcgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
ttcaaattgc ttgttccgtg ttggtggggc cgctatthtg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagtcca cacggttcga  
acgcataccg gagctgacgg caagtctttt cgttgcgctg aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggctg aacgggttaag aaaaacatag caacgttggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tggatagagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttg  
cagattgctt tagggtcagg cttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtcccaaacg gtcggtccta a

FIGURE 2-12

At173 (SEQ ID NO:25)

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaaggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actccttggt ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattca agaacaccaa cgtaaccct aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttgtt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggc ccatgatggt  
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagttca cacgggttcga  
acgcataaccg gagctgacgg caagtctttt cgttgctgct aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg  
ttgctggtcg aacgggttaag aaaaacatag caacggtggg tccgttgatt  
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa  
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acacttcac tagctcaata tgggtatgagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-13

Bn176 (SEQ ID NO:27)

atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct  
tttcaacctt tgcttctttc cggttaacggc gatcgtcgcc ggaaaagcct  
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa  
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcgggtc  
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact  
catgctacct tccaccaacg cattgtagat caagtatctc caagggtcatg  
gatatactttt atcaagtaag aaaagctgat ctttctcgga acggcacgtg  
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag  
gtctaggcga tgaaactcac gggcccagag ggctgcttca ggtccctccc  
cggaaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg  
tgcgctagaa aatctattca agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctg ttaatacttt caagctccga agcaacatca aaagctttta  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
agtcggggaga ccggagacgg tccaagtaca agctagtcca cacggtccga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
tgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcgggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttaa gcgaaaagt tctttttttc gctaccttcg tcgccaagaa  
acttctaaag gataaaatca agcattacta tgttccggat ttcaagcttg  
ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
ctagagaaga acttaggact atcgccgac gatgtggagg catctagatc  
aacgttacat agatttggga atacttcac tagctcaatt tggatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gttaagtgt aatagtgcg tttgggtggc  
tctacgcaat gtcaaggcat cggcaaata tagcttgcaa cattgcatcg  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggtccta a

FIGURE 2-14

At399 (SEQ ID NO:29).

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
cggagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctc ttaatacttt caagctccga agcaacatca aaagctttta  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggcta  
aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
agtcggggaga ccggagacgg tccaagtaca agctagtcca cacgggtccga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcgggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttta gcgaaaagtt tctttttttc gctaccttcg tcgccaagaa  
acttctaaag gataaaatca agcattacta tggtccggat ttcaagcttg  
ctggtgacca tttctgtatt catgccggag gcagagccgt gatcgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgttacat agatttgga acaacttcac tagctcaata tggatagagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttgg  
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-15

Bn399 (SEQ ID NO:31)

```

atgacgtcca ttaacgttaa gctcctttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgtaaaggc gatcgtcgcc ggaaaagcct
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcgggttc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg
gatatctttt atcaagtaag aaaagctgat ctttctcgga acggcacgtg
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccagag ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaaccct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcgatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgtggtt gataataggt ccatgatggt
ttcaaattgc ttgttcogtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagtcca cacggttcga
acgcataccg gagctgacgg caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacggttaag aaaaacatag caacggtggg tccggttgatt
cttcogttaa gcgagaaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gatcgatgag
ctagagaaga acttaggact atcgccgacg gatgtggagg catctagatc
aacgttacat agatttggga atacttcacg tagctcaatt tgggtatgaat
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc
tctacgcaat gtcaaggcat cggcaaatag tccttggtcaa cattgcatcg
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat
gtccaaaacg gtcggtccta a

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FIGURE 2-16



Bn G307D (SEQ ID NO:33)

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atgacgtcca ttaacgtaaa gtccttttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgtaaaccgc gatcgtcgcc ggaaaagcct
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcggttc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg
gatatctttt atcaagtaag aaaagctgat ctttctcgga acggcacgtg
cgatgactcg tcgtggcctg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccagagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgttaaccct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgcggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgctggg gataataggt ccatgatggt
ttcaaattgc ttgttccgtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataaccg gagctgacga caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacggttaag aaaaacatag caacgttggg tccggttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gattgatgtg
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc
aacgttacat agatttgga acacttcac tagctcaata tggtagagt
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagtttg
cagattgctt tagggtcagg ctttaagtgt aacagtgcag tttgggtggc
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcatcg
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt
gtccaaaacg gtcggtccta ataa

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FIGURE 2-17

At K92R (SEQ ID NO:35)

atgacgtccg ttaacgttaa gtccttttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgtaaaccgc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actctttgct ttactgttt tcggtttggt  
tctctacatc gtaaccgcac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgat ctcaagagta gtgtctctaa agtcatggat  
atcttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
gtctaggtga tgagacgtac agtcttgagg gactcattca cgtaccaccg  
cgaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggtcg ttaatacttt caagctccga agcaacatca aaagctttaa  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggtta  
aagacttggt gcatgttcat aaaaacactt atgctcttgt ggtgagcact  
gagaacatca cacaaggcat ttatgctgga gaaaatagat caatgatggt  
tagcaattgc ttgtttcgtg ttggtggggc cgcgattttg ctctctaaca  
agtcgggaga cgggagacgg tccaagtaca agctagtcca cacggtccga  
acgcatactg gagctgatga caagtctttt cgatgtgtgc aacaagaaga  
cgatgagagc ggcaaaatcg gagtttgtct gtcaaaggac ataaccaatg  
ttgcggggac aacacttacg aaaaatatag caacattggg tccgttgatt  
cttcctttta gcgaaaagtt tctttttttc gctaccttcg tcgccaagaa  
acttctaag gataaaatca agcattacta tgttccggat ttcaagcttg  
ctgttgacca tttctgtatt catgccggag gcagagccgt gatcgatgag  
ctagagaaga acttaggact atcgccgatc gatgtggagg catctagatc  
aacgttacat agatttggga atacttcac tagctcaatt tggatatgaat  
tagcatacat agaggcaaag ggaagaatga agaaagggaa taaagcttgg  
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc  
tctacgcaat gtcaaggcat cggcaaatag tccttggtcaa cattgcatcg  
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat  
gtccaaaacg gtcggctcta atttgatgta tctgagtgcc aacgtttact  
ttgtctttcc tttcttttat tggttatgaa ttagatgttt actaatgttc  
ctctcttttt cgttataaat aaagaagttc aattcttcct atagtttcaa  
acgcgatttt aagcgtttct atttaggttt acatgaattt cttttacaaa  
ccatctttt

FIGURE 2-18

At254 G307D (SEQ ID NO:37)

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggcttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actccttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tcctcgctcg atttcctgag gaagattcaa gagcgttcag  
gtctagggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattcg agaacaccaa agttaaccct agagagattg  
gtatacttgt ggtgaactca agcatgttta atccaactcc ttcgctatcc  
gctatggctg ttaataacttt caagctccga agcaacatca aaagctttta  
tctaggagga atgggttgta gtgctggtgt tattgccatt gatttggtta  
aagacttggt gcatgttcat aaaaacactt atgctctcgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
ttcaaattgc ttgttccgtg ttggtggggc cgctatthttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga  
acgcataaccg gagctgacga caagtcttht cgthtgctgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagtht gtccaaggac ataaccgatg  
ttgctggctg aacgggttaag aaaaacatag caacgthggg tccgthgatt  
cttccgttaa gcgagaaact tctthththt gttaccttca tgggcaagaa  
actthttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca thththgtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgthacat agattthgaa acactthcat tagctcaata tggatagagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagthtgg  
cagattgctt tagggtcagg cthtaagtgt aacagtgcag ththgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tcctthggaa cactgcacgt  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-19

At173 G307D (SEQ ID NO:39)

atgacgtccg ttaacgttaa gctcctttac cgttacgtct taaccaactt  
tttcaacctc tgtttggtcc cgttaacggc gttcctcgcc ggaaaagcct  
ctcggttac cataaacgat ctccacaact tcctttccta tctccaacac  
aaccttataa cagtaacttt actccttgct ttcactgttt tcggtttggt  
tctctacatc gtaacccgac ccaatccggt ttatctcggt gactactcgt  
gttaccttcc accaccgcat ctcaaagtta gtgtctctaa agtcatggat  
atthttctacc aaataagaaa agctgatact tcttcacgga acgtggcatg  
tgatgatccg tctcgcctcg atttctgag gaagattcaa gagcggttcag  
gtctaggtga tgagacgtac agtcctgagg gactcattca cgtaccaccg  
cggaagactt ttgcagcgtc acgtgaagag acagagaagg ttatcatcgg  
tgcgctcgaa aatctattca agaacaccaa cgtaaccct aaagatatag  
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc  
gcatggtcg ttaacacttt caagctccga agcaacgtaa gaagctttaa  
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa  
aggacttgtt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca  
gagaacatca cttataacat ttacgctggt gataataggt ccatgatggt  
ttcaaattgc ttgttccgtg ttggtggggc cgctatthttg ctctccaaca  
agcctggaga tcgtagacgg tccaagtacg agctagtcca cacggttcga  
acgcataccg gagctgacga caagtctthtt cgthtgcgtgc aacaaggaga  
cgatgagaac ggcaaaatcg gagtgagthtt gtccaaggac ataaccgatg  
ttgctggtcg aacggthtaag aaaaacatag caacgthtggg tccgthtgatt  
cttccgttaa gcgagaaact tctthttthttc gttaccttca tgggcaagaa  
actthttcaa gataaaatca aacattacta cgtcccggat ttcaaacttg  
ctattgacca thtttggtata catgccggag gcagagccgt gattgatgtg  
ctagagaaga acctagccct agcaccgatc gatgtagagg catcaagatc  
aacgthtat agathttggaa acacttcatc tagctcaata tggatagagt  
tggcatacat agaagcaaaa ggaaggatga agaaaggtaa taaagthttg  
cagattgctt tagggtcagg cthtaagtgt aacagtgcag thttgggtggc  
tctaaacaat gtcaaagctt cgacaaatag tccttgggaa cactgcacgt  
acagataccc ggtcaaaatt gattctgatt caggtaagtc agagactcgt  
gtccaaaacg gtcggtccta a

FIGURE 2-20

Bn399 G307D (SEQ ID NO:41)

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atgacgtcca ttaacgttaa gtccttttac cattacgtca taaccaacct
tttcaacctt tgcttctttc cgtaaacggc gatcgtcgcc ggaaaagcct
atcggcttac catagacgat cttcaccact tatactattc ctatctccaa
cacaacctca taaccatcgc tccactcttt gccttcaccg ttttcgggtc
ggttctctac atcgcaaccc ggcccaaacc ggtttacctc gttgagtact
catgctacct tccaccaacg cattgtagat caagtatctc caaggtcatg
gatatctttt atcaagtaag aaaagctgat ctttctcgga acggcacgtg
cgatgactcg tcgtggcttg acttcttgag gaagattcaa gaacgttcag
gtctaggcga tgaaactcac gggcccgagg ggctgcttca ggtccctccc
cggaagactt ttgcggcggc gcgtgaagag acggagcaag ttatcattgg
tgcgctagaa aatctattca agaacaccaa cgtaaacct aaagatatag
gtatacttgt ggtgaactca agcatgttta atccaactcc atcgctctcc
gcgatggctg ttaacacttt caagctccga agcaacgtaa gaagctttaa
ccttggtggc atgggttgta gtgccggcgt tatagccatt gatctagcaa
aggacttggt gcatgtccat aaaaatacgt atgctcttgt ggtgagcaca
gagaacatca cttataacat ttacgtggtt gataataggc ccatgatggt
ttcaaattgc ttgttcogtg ttggtggggc cgctattttg ctctccaaca
agcctggaga tcgtagacgg tccaagtacg agctagttca cacggttcga
acgcataccg gagctgacga caagtctttt cgttgcgtgc aacaaggaga
cgatgagaac ggcaaaatcg gagtgagttt gtccaaggac ataaccgatg
ttgctggtcg aacgggttaag aaaaacatag caacggtggg tccggttgatt
cttccgttaa gcgagaaact tctttttttc gttaccttca tgggcaagaa
acttttcaaa gataaaatca aacattacta cgtcccggat ttcaaacttg
ctattgacca tttttgtata catgccggag gcagagccgt gatcgatgag
ctagagaaga acttaggact atcgccgacg gatgtggagg catctagatc
aacggttacat agatttggga atacttcac tagctcaatt tgggtatgaat
tagcatacat agaggcaaag ggaagaatga agaaaggga taaagcttgg
cagattgctt taggatcagg gtttaagtgt aatagtgcgg tttgggtggc
tctacgcaat gtcaaggcat cggcaaatag tccttggcaa cattgcatcg
atagatatcc ggttaaaatt gattctgatt tgtcaaagtc aaagactcat
gtccaaaacg gtcggtccta a

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FIGURE 2-21